

## Claims

- [c1] <sup>Sub</sup><sub>a1</sub> 1. A method comprising the steps of:
- receiving at least M information-bearing signals; and
  - processing the at least M information-bearing signals for providing an optical wavelength division multiplexed signal having at least (N)(M) channels such that each information bearing signal is associated with a different N channels, where N is greater than or equal to two.
- [c2] 2. The method of claim 1 wherein the processing step further comprises the steps of:
- processing each of the at least M information-bearing signals with N encoders for multiply encoding each of the at least M information-bearing signals onto the different N channels; and
  - multiplexing the (N)(M) encoded signals for providing the optical wavelength division multiplexed signal.
- [c3] 3. The method of claim 1 wherein N is equal to two.
- [c4] 4. The method of claim 3 wherein the processing step further comprises the steps of:
- creating from the at least M information-bearing signals, M optical signals on M of the at least 2M channels;
  - inverting each of the at least M information-bearing signals for providing M inverted signals;
  - creating from the M inverted signals, M inverted optical signals on the remaining at least 2M channels; and
  - multiplexing the M optical signals and the M inverted optical signals for providing the optical wavelength division multiplexed signal.
- [c5] 5. A method comprising the steps of:
- demultiplexing a received optical wavelength division multiplexed signal comprising at least (N)(M) channels, wherein N is greater than or equal to two; for providing at least M groups of N optical signals;
  - processing each of the M groups of N optical signals to provide an

output signal.

[c6] 6. The method of claim 5 wherein N is equal to two.

[c7] 7. The method of claim 6 wherein the processing step further comprises the step of differentially decoding each of the M groups of two optical signals to provide the output signal.

[c8] 8. Apparatus comprising:

*Sub I*

a number of encoders for multiply encoding each of at least M information-bearing signals onto N optical channels, where N is greater than or equal to two;  
a multiplexer for providing an optical wavelength division multiplexed signal having at least (N)(M) optical channels.

[c9] 9. The apparatus of claim 8 wherein N is equal to two.

[c10] 10. The apparatus of claim 9 wherein the number of encoders comprises M inverters for inverting each of the at least M information-bearing signals to provide M inverted signals.

[c11] 11. The apparatus of claim 10 further comprising:

M electrical to optical converters for converting each of the at least M information-bearing signals into M optical signals on M different optical channels; and  
M electrical to optical converts for converting each of the at least M inverted signals into M inverted optical signals on another M different optical channels.

[c12]

12. Apparatus comprising:

*Sub II*

a demultiplexer for demultiplexing a received optical signal comprising at least (N)(M) optical channels, wherein N is greater than or equal to two, for providing at least M groups of N optical signals; and  
a decoder for processing each of the M groups of N optical signals to

provide an output signal.

[c13] 13. The apparatus of claim 12 wherein N is equal to two.

[c14] 14. The apparatus of claim 13 wherein each decoder is a differential detector.

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